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TREATABILITY STUDY REPORT

PRAIRIE METALS SITE - MISSISSIPPI

NOVEMBER 28, 1988

PREPARED FOR:

ENSITE

5119 SOUTH ROYAL ATLANTA DRIVE
TUCKER, GA 30084

PREPARED BY:

KIBER ASSOCIATES, INC.
2185 MEDFIELD TRAIL
ATLANTA, GA 30345
(404) 633-0313

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KIBER ASSOCIATES, INC.

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November 29, 1988

Mr. Chris Leggett
Ensite
5119 South Royal Atlanta Drive
Tucker, GA

Dear Chris:

Enclosed is the report of the treatability study conducted for the Prairie Metals site in Mississippi. As you will find, 25% cement proved to be of sufficient quantity to immobilize the chromium constituents to EP Toxicity limits. The fixation material developed by International Waste Technologies did not work in this case due to complexes between ammonia and the chromium compounds. IWT has however, developed another agent to accommodate this problem. KiBer intends to test this agent for our own information in the near future. We will advise you of the results as soon as they are available.

We appreciate the opportunity to work for Ensite. It is great to work with the old crowd once again. Good luck!

Sincerely,
KiBer Associates, Inc.

Neville W. Kingham
Director of Research
and Development

Tracy Bergquist
Director of Environmental
Assessments

by International Waste Technologies and will hereafter be referred to as HWT-11. This material was selected due to its proven effectiveness in the reduction of hexavalent chromium and immobilization of total chromium and other inorganics that may be present, its ease of material handling, its availability, and its moderate cost.

Although chemical fixation serves to provide a more permanent solution to the waste disposal problem, often stabilization is sufficient to immobilize the waste depending on the types of contaminants, the concentrations and the desired outcome. For this reason, both approaches were tested to evaluate the effectiveness, feasibility and cost of each option.

To facilitate understanding of the processes undertaken through this study, a separate discussion of both the Portland cement and the HWT-11 has been provided.

II. PORTLAND CEMENT

A. Methodology and Analytical Results

Portland cement was mixed with the contaminated material sample in 15%, 20%, 25%, 30%, 40% and 50% by weight mixtures. It was necessary to add approximately 2% by weight of water in order to effectively mix the sample. The samples were randomly tested on Days 1, 4, and 7 according to EP Toxicity protocol (Method 1310) for total chromium. Results are illustrated in Table #2.

It should be noted that although the cement at least temporarily immobilizes chromium to certain levels, it does not reduce the hexavalent to trivalent chromium. Therefore, any chromium that will leach will feasibly contain hexavalent chromium, a more toxic compound.

B. Operational Considerations

Although Portland cement is readily available in most areas at very low costs, certain operational factors should be considered which could have an effect in full scale implementation.

- Portland cement will solidify the material in a very short period of time. If it is to be handled to any degree, such as transportation off-site, or movement around the site, provisions should be made so that the material does not solidify in a temporary holding vessel.

- It is necessary to add approximately 2% by weight of water in order to effectively mix the cement with the contaminated material. KiBer Associates understands that there are lagoons on site which will also be addressed as a part of the cleanup. It may be possible to slurry the warehouse material with liquid from the lagoon and eliminate the need for the addition of water. This is offered only as a suggestions and is entirely dependent on the quantity of water, the location of the lagoons and other factors unknown to KiBer.

- During the stabilization process, it was noted that upon addition of cement, the mixture emitted a strong ammonia odor. The release of this ammonia gas is likely to be associated with the heat reaction which is also present with the use of cement. The greater the concentration of cement required, the hotter the reaction and the stronger the ammonia odor. On a large scale, this could prove detrimental if neighboring residences or businesses are in close proximity to the site. If cement is used, personnel in the area should be properly protected and if feasible, mixing operations should be conducted in the most remote areas of the property to prevent any public relations problems.

- No elaborate pretreatment operations or pulverization should be required if site conditions are generally consistent with that of the samples received by KiBer. KiBer recommends however, that a pugmill or similar equipment be used in order to ensure adequate mixing.

III. INTERNATIONAL WASTE TECHNOLOGY'S HWT-11

A. Methodology and Analytical Results

The HWT-11 agent was developed for heavy metals contaminants and was selected for this project based on analytical data provided by Ensite. The agent consists of two materials. The first material is a liquid catalyst which serves to; a) reduce the hexavalent chromium to trivalent chromium in a basic state (pH is maintained at 9.0 or above), and b) cause a greater dispersion of the solid fixation particles which will in turn promote better development of the bonding function. Once the catalyst has been introduced to the contaminant mixture, and sufficient retention time has been allowed (30 seconds), the second material is added. This material is a dry powder which chemically interacts with the inorganic contamination thus reducing the leaching potential.

As with the cement, a number of concentrations were mixed to determine the applicability of this material to the waste at Prairie Metals. HWT-11 with 1% catalyst was mixed in 5%, 10%, 15%, 20%, 25%, and 30% by weight mixtures.

The results of the HWT-11 fixation procedure shows that the state of fixation is not attainable with any mixtures of feasible concentrations. In order to fix the contaminants using these methods, quantities exceeding cost effective limits would be required. Two hypotheses were developed from this study. They are the following: 1) Since the purpose of the HWT mixtures is to target many compounds in an effort to immobilize all contaminants, the abundance of other compounds found in the ferrous ammonium sulfate are utilizing the fixation material to attack inorganics and organics which are not evaluated as a part of this treatability study. Because of this, insufficient fixation material remains to immobilize the more difficult chromium constituents. 2) Based on theoretical calculations the ammonia is complexed with the chromium thus preventing the fixation mixture from interacting with the chromium. Additional analytical would be required to evaluate this prospect.

B. Operational Considerations

Certain operational factors should be considered in the use of the HWT-11 fixation agent. They are as follows:

- During the testing with the HWT-11 the ammonia smell was not present; however, a conversion of the chemical constituents emits a faint sulfide smell. There is a mild heat release with this material but is not as significant as in the cement tests.

- Since a liquid catalyst is used in the fixation process, it is not necessary to use water to mix. The catalyst requires at least a thirty second retention time prior to addition of the solid portion.

- As with the cement, it may be favorable to mix materials from other areas of the site in order to disperse the highly contaminated materials with the less contaminated soils and therefore increase the fixation efficiency.

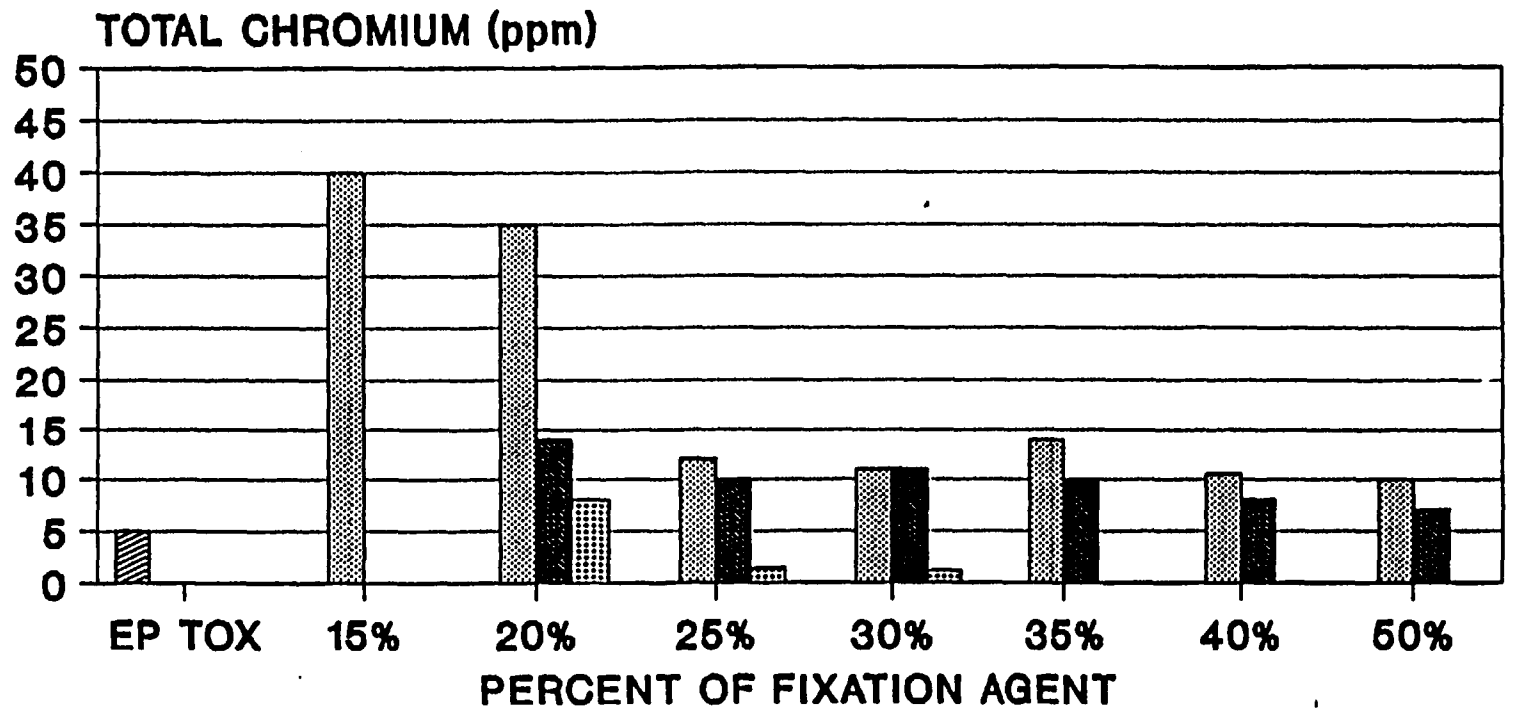
- Also as with the cement, no elaborate pretreatment or pulverization is required if site conditions are generally consistent with the samples provided to KiBer. We do recommend that thorough mixing is attained through the use of a pugmill or similar material handling equipment.

IV. CONCLUSIONS

Based on the treatability study results, the cement mixtures of 25% and 30% encapsulated the chromium and passed E.P. Toxicity limits of 5 ppm after seven days. Although the cement can be an effective means of stabilizing the contaminated material, it does not reduce hexavalent to trivalent chromium. As shown in the analytical tables however, there is very low concentrations of hexavalent chromium (0.8 ppm) in the original untreated sample.

As illustrated in the tables the HWT material did not pass E.P. Toxicity criteria. As stated previously, it is speculated that the ammonia is creating a complexion interference. At the writing of this report, IWT has developed a new material which should break the ammonia bond. A series of tests will be initiated by mid-December with results by mid-January. If requested KiBer will forward the results.

KIBER ASSOCIATES, INC.
TREATABILITY STUDY - PRAIRIE METALS



PORTLAND CEMENT
FIGURE 1

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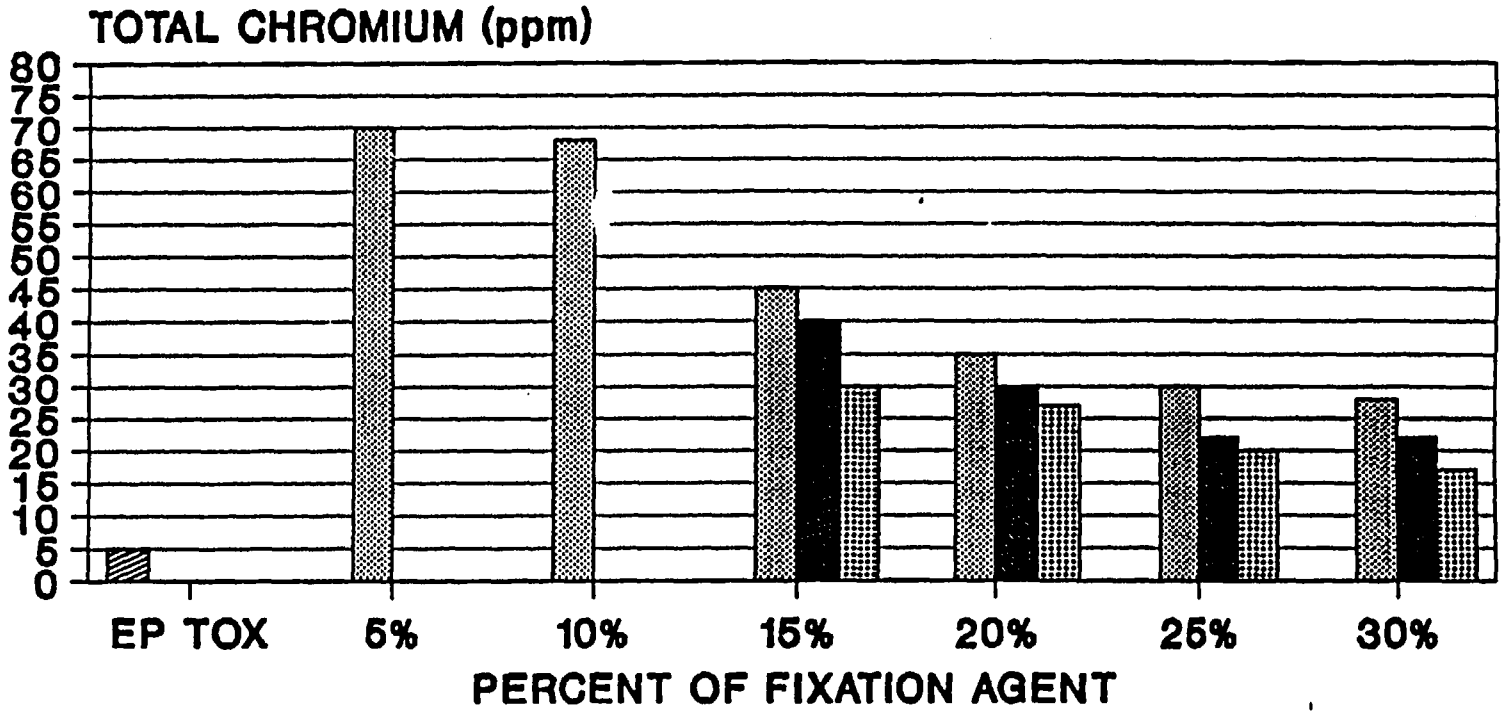
TREATABILITY STUDY - PRAIRIE METALS SITE



HWT-11 WITH 1% CATALYST

FIGURE 2